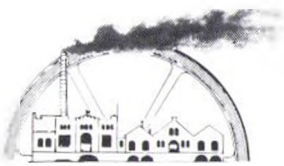
Nederlands Stoommachinemuseum

ENGLISH

Oosterdijk 4, 1671 HJ Medemblik, tel. 0227-544732



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Wij vragen:

* enthousiasme en belangstelling voor het museum
* een minimale beschikbaarheid van 10 agen per jaar
* minimum leeftijd van 18 jaar

Wij bieden:

* een plezierige en unieke vrijetijdsbesteding
* een afwisselende functie
* kans op nieuwe sociale kontakten
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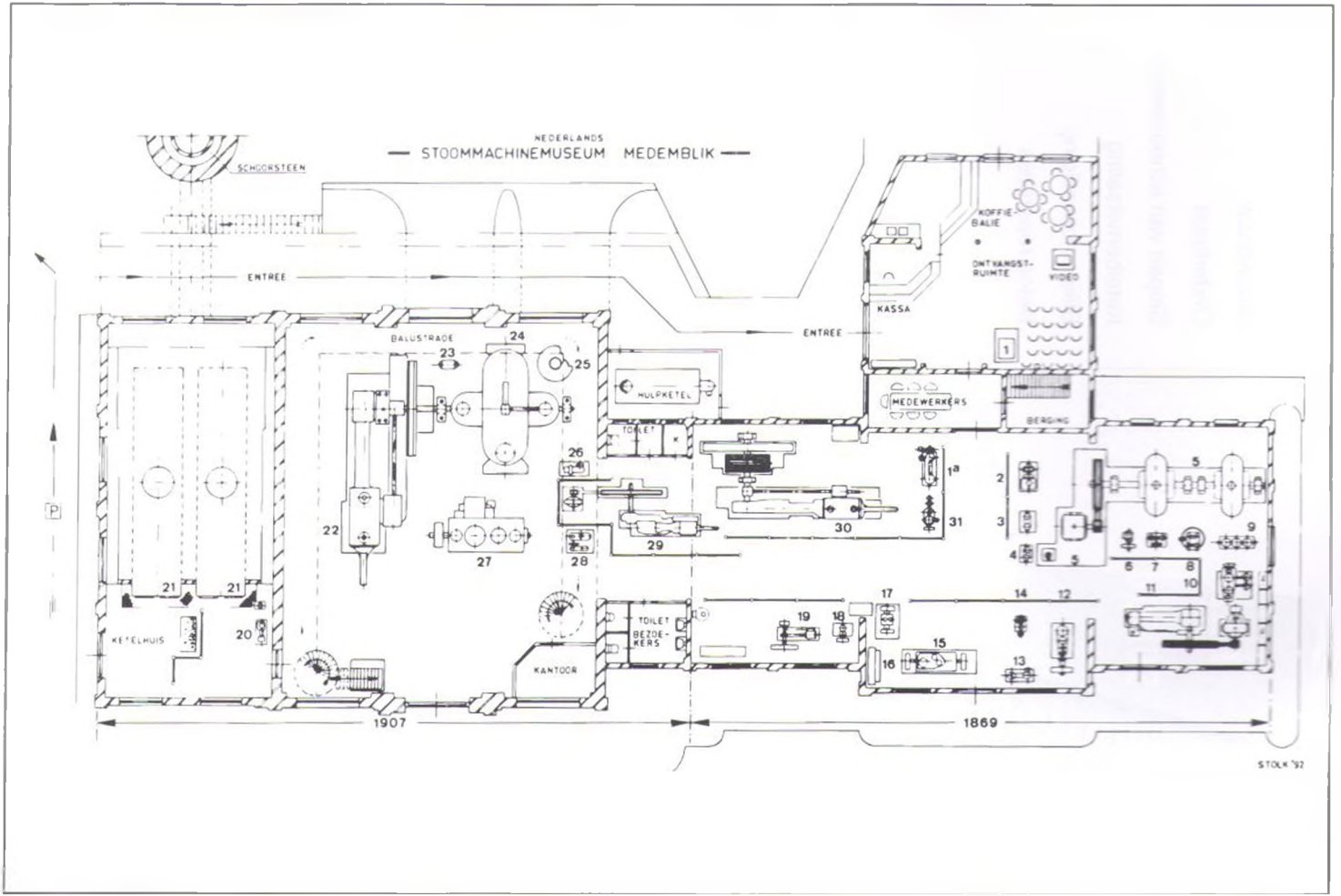
NEDERLANDS
STOOMMACHINEMUSEUM MEDEMBLIK
SCHOORSTEEN
ENTREE
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BALUSTRADE
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TOILET
KASSA
KOFFIE HALTE
ONTVANGST-RUIMTE
VIDEO
MEDEWERKERS
BERGING
KETELHUIS
KANTOOR
TOILET BEZOEKERS
1907
1869
STOLK '92

Introduction

In this booklet you will find a detailed description of the steam engines you can view in our museum.
The information given in the exposition is here supplemented with technical details, background information and photographs of the steam implements.

The intention of this booklet is to give you more detail, but we realise that it is not complete.
It also is a lasting souvenir of the Dutch Steam Engine Museum and it gives useful additional information during your tour through the museum.

layout of the guide

The booklet commences with an introductory part. Here you can read about the original setup of the museum, the history of the pumping station "Vier Noorder Koggen", the history of the steam engine and the workings of the piston steam engine.
In the next part you will find information about the collection. The numbers and the order of the objects are the same as you find them in the exhibition.

The front and back of the guide

At the begin of the booklet you find a map of the placement of the exhibit in the museum at the end you find a list of technical terms with their explanation.

The origins of the museum

In the early seventies mr. C. P. Jongert starts single handedly the restoration of a number of steam engines. By doing this he lays, without realising it, the foundation for the Dutch Steam Engine Museum. The museum becomes a certainty when on a small scale an exhibition is setup in the former goods shed of the Medemblik railway station. There is so much public interest and the number of engines grows so rapidly that soon a new and larger space is needed.
Since 1976 the steam pumping station "Vier Noorder Koggen" is seldom used anymore. Reason being that after the resizing and redistribution of land, and the building of a new pumping station in Wervershoof its function has become obsolete. Since 1975 the building is listed as a historical monument.
To preserve the pumping station and to give it a new function a workgroup has been started. After negotiations between the steam engine museum and the Waterboard West-Friesland, the new function of the building has become a fact: the Dutch Steam Engine Museum is to exploit in the old pumping station "Vier Noorder Koggen" as a museum, based on the collection of mr. Jongert.
Following subsidies from Monumentenzorg and the Prins Bernard fund it is possible to restore the pumping station in 1982. In March 1983 a conservator is appointed, who will look after the restoration and fitting out of the museum.
Due to his efforts and the efforts of some volunteers and mr. Jongert, the museum opens its doors in the summer of 1984 with a temporary exhibition.
In the following period the experiences gained during this first opening are incorporated in the further arrangement of the museum.
Eventually on the twentyfirst of June 1985 H. R. H. Princes Margriet officially opens the Dutch Steam Engine Museum by letting blow a big steamwhistle.

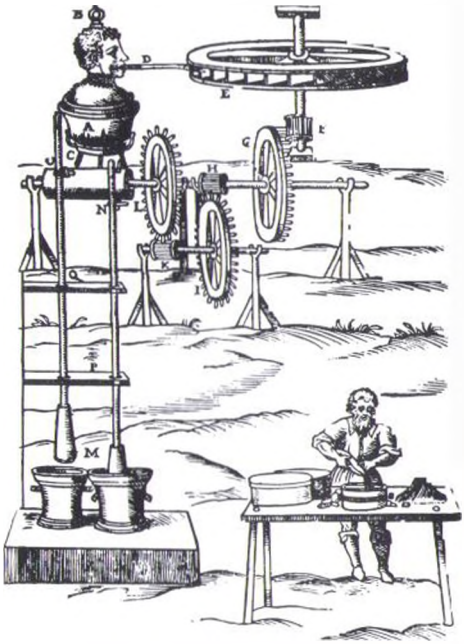
History

Humans forever search after means to move faster and to generate more power. Sources of power that are stronger than the muscles of the human body and that can perform work for a person.
Well into the seventeenth century people used animals, wind and water power. Horse and wagon, windmills and water-wheels, sailing ships. However all these depend on the wheather: barely a sigh of wind and the windmill moves too slow.

Engines and machines are reliable and always available, good or bad wheather.
During the eighteenth century these are developed; an era in which a large number of inventors and technical researchers make machines. Especially in England: Thomas Newcomen builds in 1712 the first usable steam engine. And around 1765 James Watt uses this invention and turns it into a very effective source of power.

The steam engine was used in many places: first in the coalmines, quickly thereafter in factories and later even in ships and in trains.
The steam engine caused the 'Industrial Revolution' (1750 - 1820): the rise of our modern world of machines and engineering, of industries and factories and faster transport.
A new world in which the steam engine is for a while the symbol.

Not until the twentieth century do new engines replace the steam engine: engines using oil, gas or electricity.
But in our museum it is the steam engine that is still going strong!



what is steam?

Steam is a gas, you can't see it, you can't smell it and you can't taste it.....
Steam is produced by heating water. The water boils at a certain temperature and pressure: in The Netherlands at normal atmospheric pressure water boils at 100° centigrade. While boiling, it slowly turns into steam: from a whistling kettle of boiling water a column of steam issues escapes.
Initially the steam immediately above the spout is invisible. Then the steam cools and there appears a haze: a white plume hangs above the kettle. This however is not steam, but it exists out of very fine water droplets.

under pressure

We have a saying here: 'there is pressure on the kettle', which indicates there exists a certain tension.
The same goes for the whistling kettle, for the 'volume' of the steam is much larger than that of the water: 1 litre of boiling water expands to nearly 1700 litres of steam!
The steam needs more space than is necessary to hold the water. This causes pressure in the kettle and the steam wants to escape. And it has found a way: via the spout the steam escapes.

the installation

A steam installation exists of three parts: the steam boiler, the steam engine and the pipe that connects these two.
The steam boiler is completely closed. Fire in the boiler produces heat - boiling water - steam. If steam cannot escape then the pressure will rise. But there is an escape: through the connecting pipe the steam can enter the engine part.
One speaks of the operating pressure of a steam engine: the pressure or the force of the steam in the engine. The unit of measurement used for this is 'atmosphere', or these days bar (1 ato = 1.0336 bar).
The average operating pressure of piston steam engines in the museum is 10 ato.
The pressurised steam moves the steam engine, to ultimately drive another tool.

A steam engine is a tool, capable of turning thermal energy from steam into mechanical energy.

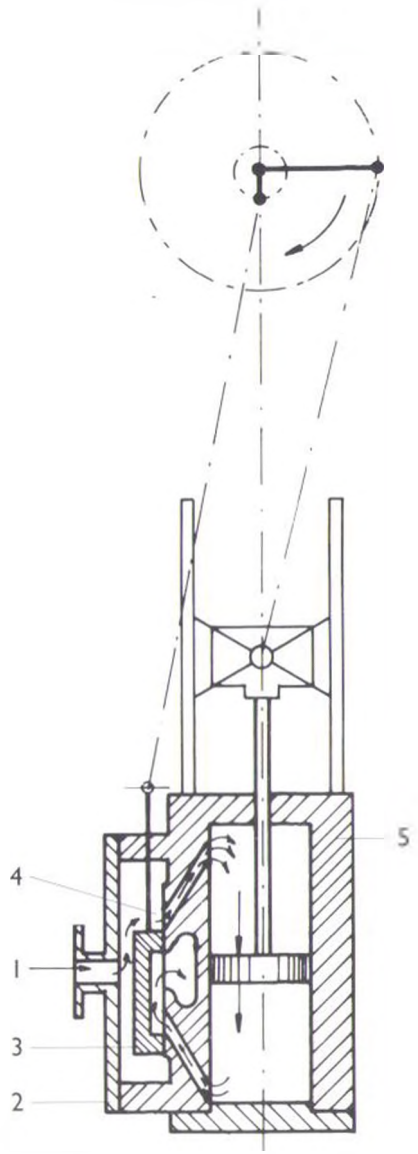
In other words, heat is turned into movement.
There are piston steam engines and steam turbines. We will restrict ourselves here to the piston steam engines.

The operation of the piston steam engine

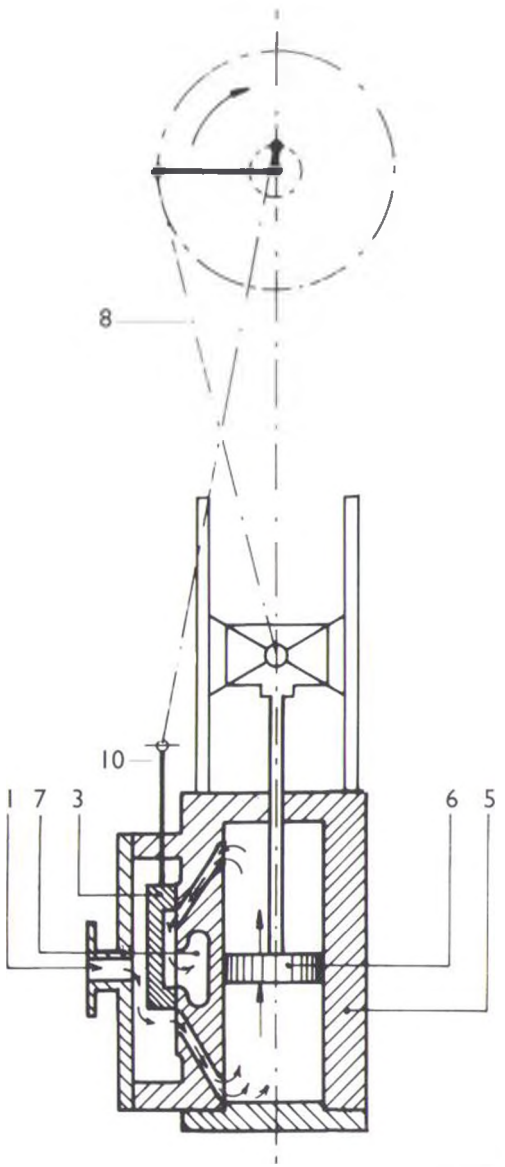
In a piston steam engine the steam pushes a piston backwards and forwards within a cylinder. And it is that movement that is important: it puts the engine itself into movement and ultimately also another tool.
How it all works, you can see in the following text and drawings.

1. **Incoming steam tube.**
   Connected to the steam boiler. Here new steam enters the engine.
2. **Steam slide valve chest.**
   Forms one complete part with the cylinder. Steam enters here first, on its way to the cylinder.
3. **Steam slide valve.**
   Its position forces the steam to follow a certain route into the engine.
4. **Valve face with steam ports and steam canals.**
   Separating wall between the steam slide valve chest (2) and the cylinder (5). In here there are three apertures or steam ports. In the drawing the steam slide valve leaves the upper steam port open: now the steam finds a way into the cylinder.
5. **Cylinder.**
   "Tube" in which the piston moves.
6. **Piston.**
   This is a round disc mounted on a rod. The incoming steam pushes down from above onto the piston: this causes it to descend.
   A small amount of steam is needed for this: the incoming steam needs to fill the cylinder only partly and through the steam pressure the piston starts to move. Then the steam supply is halted: the pressure falls, but the expansion of the steam in the cylinder causes a further movement of the piston.

Incoming stroke



Outgoing stroke



7. Exhaust steam canal.
Below the piston there remains steam, the 'used' steam. This will have to be cleared from the cylinder, otherwise the piston will experience a back pressure. Through the lower steam port (4) the steam leaves the cylinder. And the position of the steam slide valve (3) determines the route to follow: via the centre steam port the used steam finds its way out.

8. Connecting rod and crank shaft.
Outside the cylinder these are connected to the piston rod (6). The movement of the piston causes the turning of the crank shaft. With this the engine drives another tool.

9. Flywheel.
The flywheel assists the engine to turn past the dead point (when crank shaft and connecting rod form one line). It also ensures that the engine turns evenly with a nearly constant speed.

10. Steam slide valve rod.
This is connected with the crank shaft outside the slide valve chest. The movement of the piston moves the steam slide valve (3): adjusted so, that the incoming and outgoing supply of steam occurs always at the right moment.

When the piston is at the bottom of the cylinder, then the steam slide valve is near the top: now the lower steam port (4) is open.
Then the whole proces starts anew, but in reverse order.

The atmospheric engine of Newcomen

England at the beginning of the eighteenth century. Everywhere there are tinmines and coalmines. It is difficult to reach the lower levels, because of flooding and leakage of water from the surface into the mine.
Then Thomas Newcomen builds in 1712 a useful steam engine: an engine that operates a pump and so pumps away the groundwater. This engine is installed in a tinmine in Cornwall and soon more and more are used to remove groundwater in many mines.
Near the entrance into our museum you find a model of this engine.

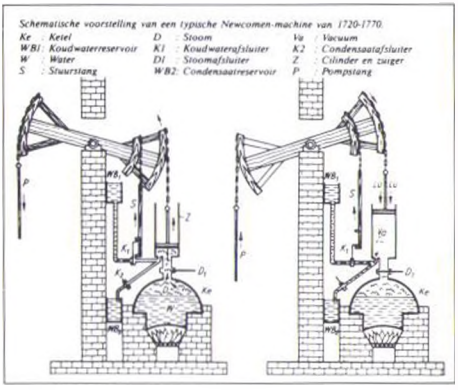
technical details

The Newcomen steam engine is also called an 'atmospheric engine', because it is the pressure of the outside atmosphere that moves the piston down. It is a beam engine: the beam is on the one side connected to the piston in the cylinder and on the other side connected to the pump.
The weight of the pump rod with chain is much langer than the weight of the piston rod and chain: that is why at the begin phase of the engine the piston is at the top of the cylinder.

To start the engine a tap is opened between the boiler and the cylinder (the pressure in the boiler is approximately 0.5 ato): the steam is let into the cylinder until the cylinder is warm. Then the tap is closed again. Next cold water is sprayed into the cylinder. The steam cools to water again, about 1700 litres of steam condense to 1 litre of water. In this way a vacuum is created in the cylinder. No air (steam) also means no pressure.
The cylinder is open at the top and now the outside air pressure pushes down the piston. The piston descends and pulls through the beam the pump piston up: now the engine pumps water up.

James Watt

James Watt improves eventually the Newcomen steam engine: he makes the engine more efficient in the use of steam and adapts its use for driving tools in factories.
In 1765 Watt introduces the condensor, his most important invention: a separate compartment outside the cylinder where the steam cools.
This improves the output of the engine by more than 300%. For, with the Newcomen engine the cooling occurred in the cylinder each time: so with each stroke the cylinder had to be warmed up again, this costs energy.
Later on in 1768 Watt sees in Seaton Delaval a rotary engine, made by Oxley. This leads to the introduction of gearwheels by Watt. Gearwheels transfer the power from the connecting rod to the shaft with the flywheel (the use of the crank shaft - connecting rod mechanism is not possible for Watt, as the patent for this is held by Pickard).
From this moment the steam engine can be used to operate tools and machines in factories. The Newcomen engine could not be used, as it only had an upwards and downwards movement.



The collection of the Dutch Steam Engine Museum

Introduction

Texts appearing under this symbol are introductory texts pertaining to the origin of the steam engine, the operation of the steam engine and the history of our museum.

ship's engines

"Full steam ahead!" and the ship moves, propelled forward by a steam engine. To go backwards the engineer has to stop the engine first and then let it turn in reverse order. Two drive directions: it is the characteristic of the steam engine in a ship.
Mostly these ship's engines are build vertically, for this way they use little floorspace and so leave more room for cargo.
After 1870 steam shipping expands rapidly and steam engines are used to power the ships.

The majority of the ship's steam engines in our museum come from dredgers. These dredgers are a type of ship that is used to dredge ditches, canals or even areas in the sea.
More about the ship's engines in our museum you can find further on in the booklet. You will recognise them by the above symbol.

Land engines

Land engines are steam engines used in factories and other places of activity. You will recognise them by their horizontal built. Building horizontally has the advantage that personnel have easy access to service and maintain the engine.

On top of that, the engine need not labour against gravity as is the case in the up-stroke of the piston of the vertical engine. Thus the engine will run smoother. And of course there is enough floorspace in a factory to build horizontally.

After 1800 steam engines operate in factories: on the factory floor the production engines turn, driven by a large steam engine.
The land engines of our collection are listed in more detail later on in this booklet. You will recognise them by the above symbol.

building

The building in which our museum is housed, used to be the steam pumping station of the Waterschap "Vier Noorder Koggen". For a long time the pumping station had an important role to play in maintaining the waterlevels in this area, in conjunction with the windmills in the polder.
The engines belonging to this building are also discussed in detail later on in this booklet. You can recognise them by the above symbol.

History of the building

1869

In 1869 the pumping station is built with the following installation: a boiler room with a chimney, a steam engine, two paddlewheels and two screwjacks. Also there was built a coal storage, a dwellinghouse for the engineer and a smithy.

The pumping station was to aid the windmills in the polder in pumping off the water from the polder into the Zuiderzee.
In normal conditions the 15 windmills south of Medemblik are capable of performing this task. The mills pump the water into a millpond, connected to an engine pond. From this engine pond the water can flow into the Zuiderzee.
But when the waterlevel in the Zuiderzee is too high, the windmills can't handle it on their own and the pumping station is operated. The connection between the millpond and the engine pond is closed and the paddlewheels of the pumping station bring the water from the millpond into the Zuiderzee. The screwjacks are operated when the paddlewheels are not used. This is the case when the windmills can't pump enough water into the millpond.

The pumping station of this period is the northern part of the present building. It can be recognised by the yellow floor area.

1897

In 1897 the paddlewheels and the screwjacks are replaced by four centrifugal pumps. Also, two new steam engines are installed to replace the old one. The boiler room remains the same.
The stepped method of pumping using the millpond is not necessary anymore now. The water can be pumped straight from the polderlevel into the Zuiderzee. The windmills remain in use as well.
However all is not perfect yet. The farmers wish for better management of the waterlevels in the polder.
For instance in 1905 there is a long windless period (157 days) combined with a too high waterlevel in the Zuiderzee (31 days). The windmills cannot operate then.

1907

In 1907 there is an attempt to make the whole system independent from the influence of nature. The pumping station is expanded with the installation of a gasfuelled engine that operates a large centrifugal pump.
The present boiler room is then a space with an gasgenerator. The gas generated serves as fuel for the gasfuelled engine. The capacity of the pumping station is now so large that the windmills are not needed anymore.
This enlargement of the pumping station is the southern part of the present building. In this period it was operated together with the northern part.

1924

In 1924 the gasfuelled engine is worn out and is replaced by a steam engine. In the boiler room two boilers are installed and outside the current chimney is erected.

1939

In 1939 the old, northern part is modified: two electromotors are installed to replace the steam engines. The boiler room is cleared and the chimney is pulled down.

1971

The 'Service for Steam Regulations' condemns the steam boilers. As a temporary measure a diesel engine is installed to operate the pump.

1977

In 1977 the pumping station finishes its pumping days and a new pumping station is built near Wervershoof. The polder "Vier Noorder Koggen" becomes part of a larger drained area.

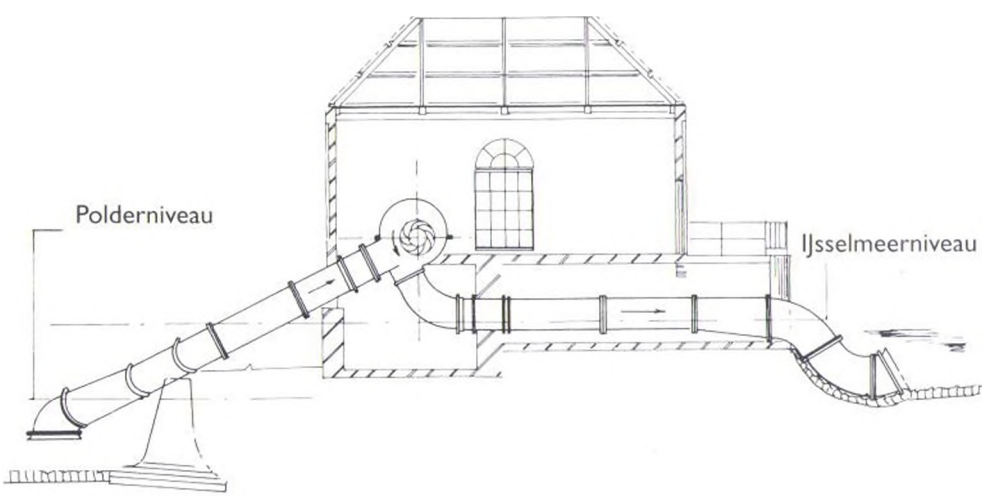
1985

In 1985 boiler nr. 4 is fixed and approved. Now again a steam engine is the operating force behind the machines in the building. After a period of restoration the building was in 1985 opened as the Dutch Steam Engine Museum.

In the museum you can view:
- two centrifugal pumps from 1897,
- the centrifugal pump from 1907,
- the steam engine from 1924,
- the steam boilers from 1925,
- an electromotor from 1939.

Exhibition "West-Friesland above water"

In this exhibition you also find the story about the management of the waterlevels in the area called the "Vier Noorder Koggen" and the role the pumping station played in it.
The exhibition is arranged on the balustrade in the museum.



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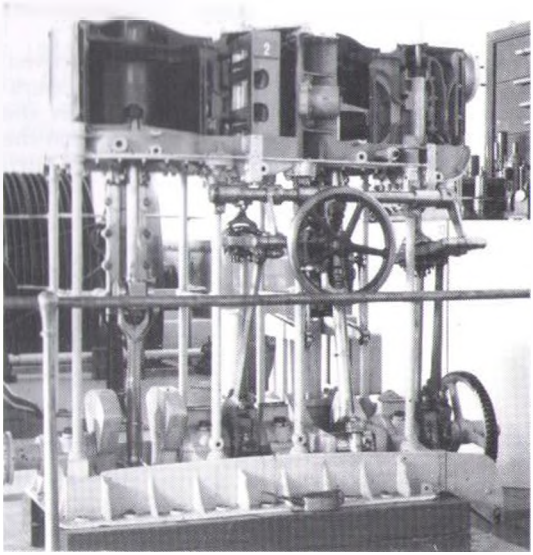
Ship's steam engine from a river cannonboat



object: steam engine,
two cylinder, vertical, compound
built by: Christy, Nolet & de Kuyper, Delfshaven
year of construction: around 1875

engineering,
stroke: 230 mm
bore: 290 / 485 mm
operating pressure: 6 ato
energy: 60 hp
reverse movement: Stephenson
slide system: H. P. jacket valve,
L. P. Penn - valve

size LxWxH: 2.0 x 1.1 x 2.0 m
total weight: 1600 kg

This is an openworked model of a two cylinder vertical compound steam engine. The engine is on loan from the Navy museum.
If you wish to know how this engine works, just ask one of our assistants for a demonstration...
And talking about our assistants: there is only one full-time employee at the Dutch Steam Engine Museum Foundation. This conservator is assisted by a group of 50 à 60 enthousiastic volunteers.

New volunteers: we are always looking for new volunteers for a variety of tasks. It is not necessary that one is technically skilled or that one has indepth knowledge of steamengines.
If you want to know more about this, then direct your enquiries to one of the volunteers or to the conservator.
Of course you can also ring 0227-544732, or you can write to the Dutch Steamengine Museum.

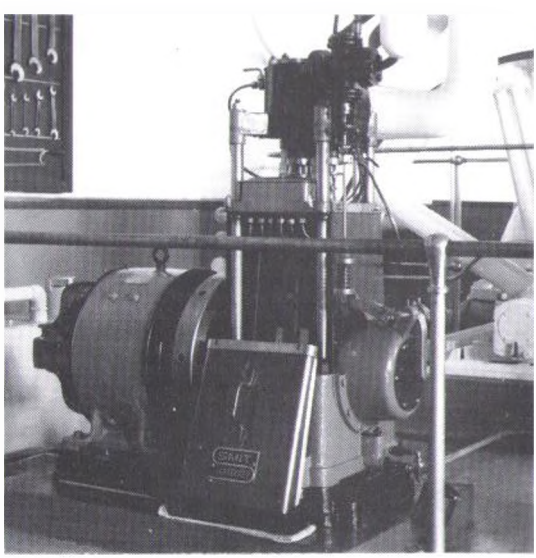
Light engine

object: steam engine, vertical, one cylinder
built by: Smit, Slikkerveer
year of construction: around 1930

engineering,
stroke: 125 mm
bore: 125 mm
nr. of revolutions 450 turns/min
operating pressure: 10 ato
energy: 7 hp
slide system: jacket valve
details: continuous greasing

size LxWxH: 1.5 x 0.9 x 1.75 m
diameter flywheel: 550 mm
total weight: 750 kg

Around 1930 this engine is used to assist with the lighting on board of ships and dredges.
The steam engine operates a dynamo (generator) that generates electricity. (110 volts Direct Current, 40 amps).
The energy of the generator is 4.4 kw: this will power some 75 lamps of 60 watts each. The machine does not have batteries, so there is only light when the engine operates. The engine cannot be stopped for oiling: so underneath the engine there is an oil reservoir. A small pump pumps the oil from here to a distributor, from here the oil flows through grease pipes to the bearings.
The engine is often called "Light engine" or "Smithy" (after its builder) by the engineers.



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Engine from the dredger 'Toos'

This engine is from the dredge 'Toos', once owned by the firm of De Koning from Medemblik. A smaller type of dredge used for canals. For years the engine operates the chain of buckets. The engine is from 1907.

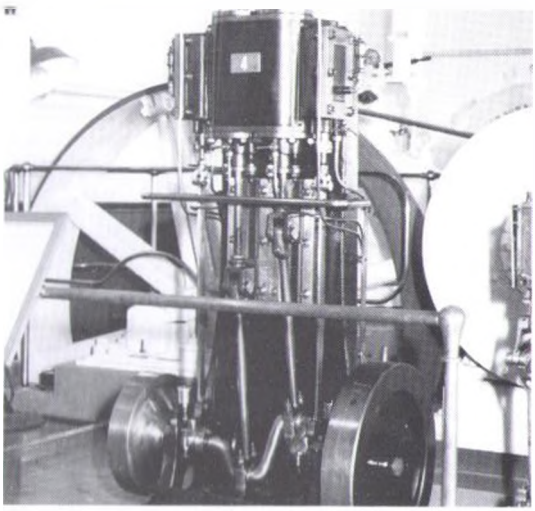
the chain of buckets

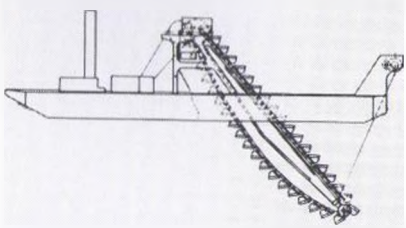
The dredge is a flatbottomed boat (a pontoon) used for the dredging of ditches and canals or the sea. The dredging is done with a chain of buckets: a belt fitted with buckets that continuously loops around. Partly above the deck and partly below the boat. The bottom of the dredge has a U-form (two parts with the chain in between) and that way the buckets can reach the bottom of the canal.
The buckets are empty when they go under water, they scrape the bottom of the ditch and are filled with sand or gravel. When the buckets are again at the highest point of the chain, they empty their contents in a storage container and then the whole process starts again.

object: steam engine, vertical twin
built by: 'de Hollandsche IJssel', Oudewater
year of construction: 1907

engineering,
stroke: 255 mm
bore: 110 mm
nr. of revolutions 80 turns/min
operating pressure: 10 ato
energy: 10 hp
slide system: shell valves

size LxWxH: 0.95 x 0.75 x 2.1 m
diameter flywheel: 400 mm + 600 mm
total weight: 1000 kg



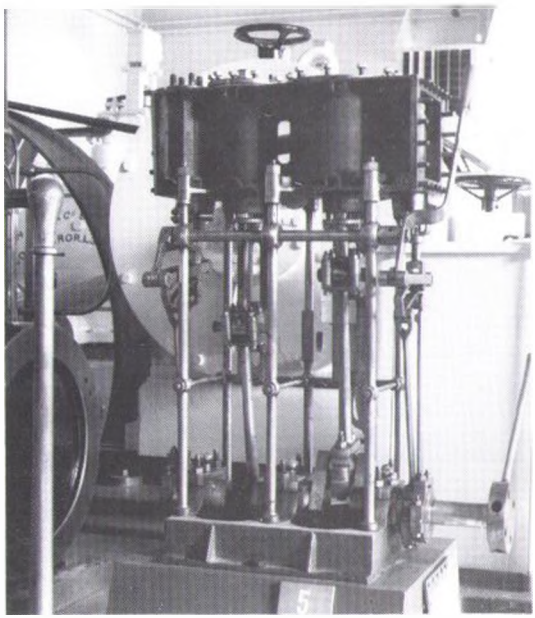


Engine from a steam launch

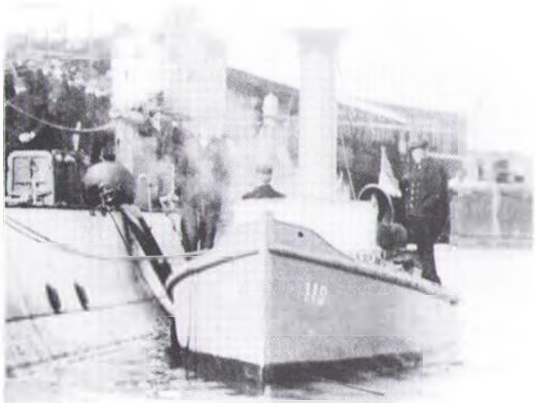
object: steam engine, vertical compound
year of construction: 1890

engineering,
stroke: 150 mm
bore: 100 mm and 180 mm
nr. of revolutions around 200 turns/min
operating pressure: 6 ato
reverse movement: Stephenson
slide system: H. P. jacket valve, L. P. shell valve

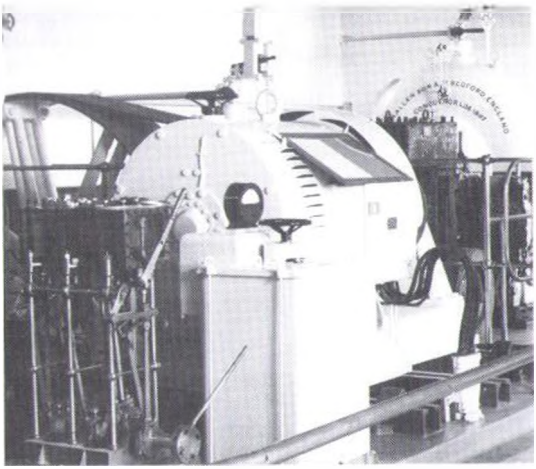
size LxWxH: 0.8 x 0.6 x 1.20 m
total weight: 200 kg



Around 1900 this small steam engine operates a steam launch: a type of sloop for groups of people, used by the Navy.
Just as these days a small boat is propelled by a small inboard engine.



Electromotor from the pumping station and two centrifugal pumps



object: electromotor
built by: Smit, Slikkerveer
year of construction: 1939

engineering,
nr. of revolutions 730 turns/min
energy: 225 hp, 165.5 Kw, 380 volts, 309 amps

size LxWxH: 1.9 x 1.4 x 1.6 m
total weight: 6000 kg

object: two centrifugal pumps
built by: W.H. Allenson & Co, Bedford
year of construction: 1897

engineering,
nr. of revolutions 180 turns/min
energy: 100,000 litres per minute per pump, at a pressure head of 2 m

size LxWxH: 7 x 1.4 x 2 m

Since 1897 these centrifugal pumps stand in the pumping station. In those days the windmills in the polder pumped the water into the 'millpond' (reservoir) next to the pumping station. However the centrifugal pumps can pump the water directly from polderlevel into the Zuiderzee. The electromotor operates the centrifugal pumps.

centrifugal pump

A centrifugal pump consists of a pumping house, with on both sides a suction tube and a discharge tube in the middle. Mounted in the pumping house is a fan with blades.

First the pumping house is filled with water: with a separate vacuum pump the air is sucked from the pumping house. (The waterlevel rises through the suction tube of the centrifugal pump.)
When the fan starts to turn the water is thrown out. The pressure is building up in the outer part of the pump house and the water flows into the delivery tube.
In the centre of the fan a lower pressure exists and this causes the installation to suck water inside. Then the water is thrown out again.

The electromotor is connected through V-belts to the pump.

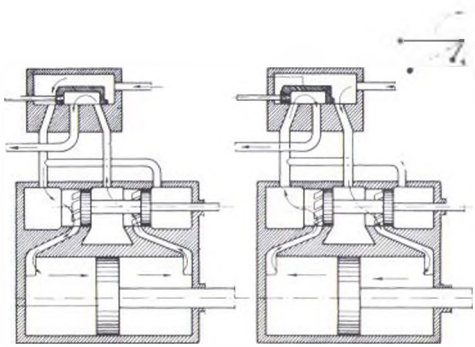
Engine from a pile-driving installation

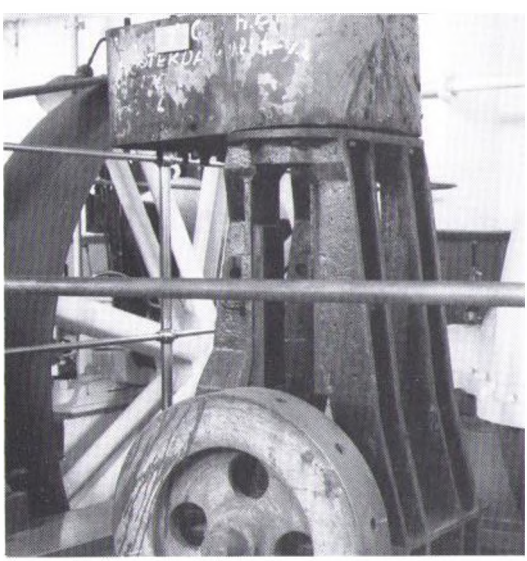
object: steam engine, two cylinder
year of construction: 1960

engineering,
stroke: 180 mm
bore: 170 mm
nr. of revolutions around 300 turns/min
operating pressure: 10 ato
energy: 60 hp
reverse movement: reverse valve
slide system: piston valve

size LxWxH: 1.0 x 0.7 x 1.5 m
diameter flywheel: 650 mm
total weight: 1500 kg

This steam engine is operated around 1960 in the Middle East at a pile-driving installation: the engine is used to hoist piles. A horizontal model is used for the swiveling.





7

Steering engine

Around 1930 this machine is used for the servicing of the rudder of a ship.

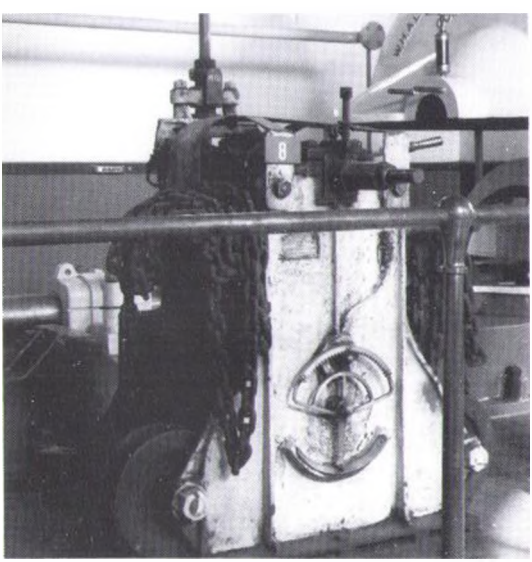
steering reinforcement

The steering engine is situated in the cockpit or in the engineroom. In the latter case the movement of the steering wheel is relayed to the engineroom via gearwheels and axles. The chains from the engine run via drums to the rudder quadrant, which turns the rudder.
This engine is from a ship that had a length of 30 m, for instance a steam tug. Then the steersman has a choice: he can service the rudder directly, with musclepower through a large steering wheel, or he lets the steering engine do the work and he steers using a small steering wheel.
The engine can be looked upon as a sort of steering reinforcement.

object: steering engine, two cylinders
built by: Donking & Co, Newcastle on Tyne

engineering,
stroke: 120 mm
bore: 120 mm
operating pressure: 10 ato
reverse movement: reverse valves
slide system: piston valves
details: nr. 7687

size LxWxH: 1.0 x 1.0 x 1.5 m
total weight: 900 kg

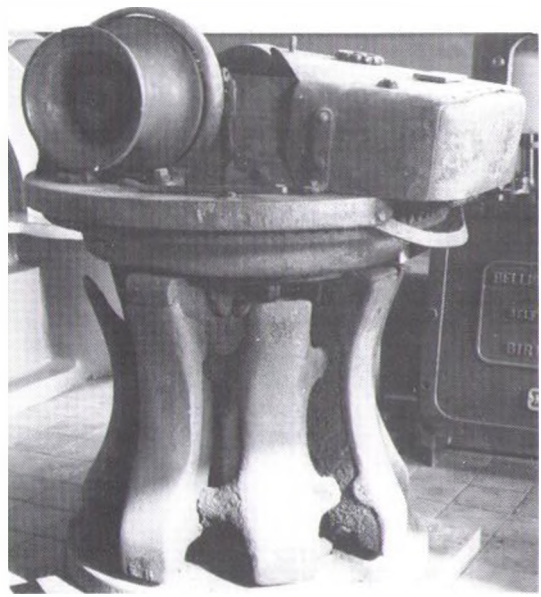


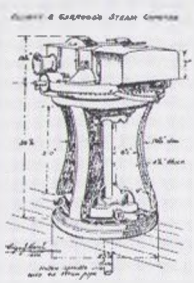
Capstan

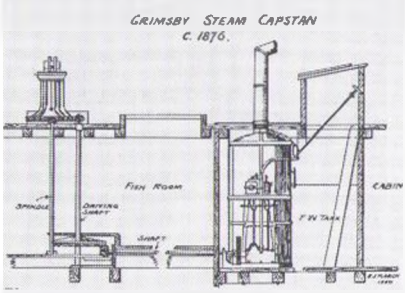
object: capstan, two cylinders, horizontal
built by: Elliott & Garrood
year of construction: 1900

engineering,
stroke: 110 mm
bore: 850 mm
operating pressure: 8 ato
reverse movement: none
slide system: shell valve
details: engine on top of the capstan

size LxWxH: 0.9 x 1.0 x 1.1 m
diameter flywheel: 290 mm
total weight: 700 kg



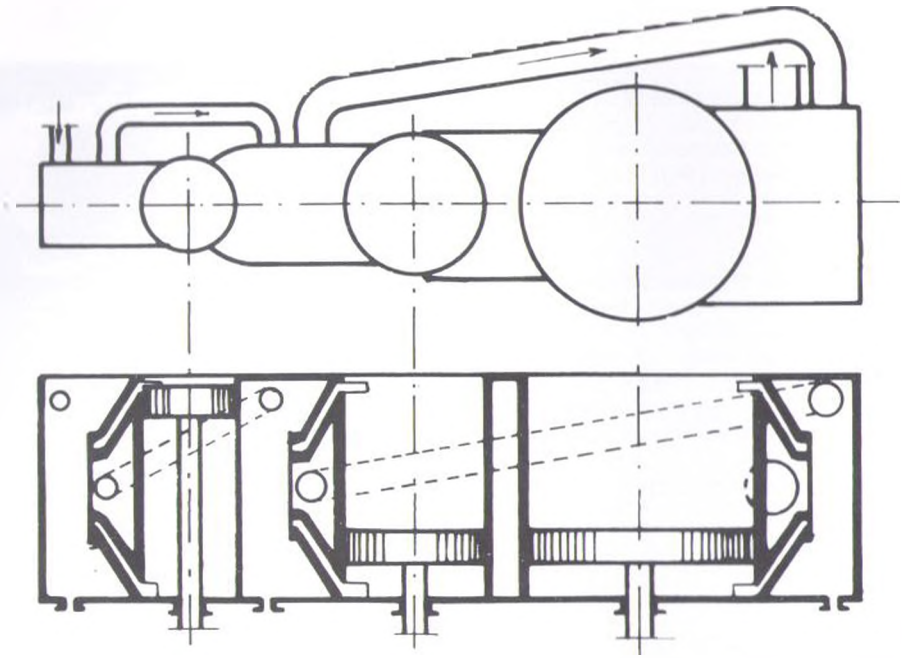




In 1900 used on board of fishing boats: the engine is used to reel in the nets. The engine is of English origin. Around 1930 Dutch shipowners buy ships with such engines on board. Already before the event of steam ships this engine was used, having its own small steam boiler.

drum

Near the bottom end of the engine you see a 'drum': around this drum the rope connected to the fishing nets is strained. When the engine is operated the rope is turned around the drum and the nets are reeled in.

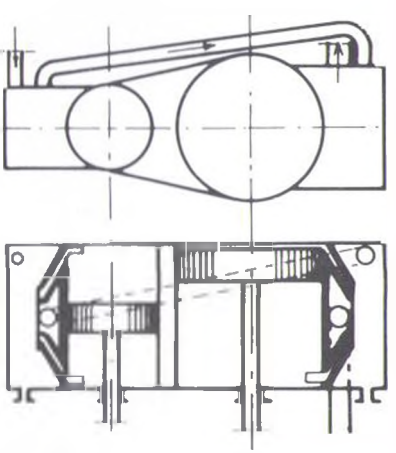


compound

In a piston steamengine the steam cools through expansion, and therefore also cools the cylinder wall. Every time new steam enters the cylinder, some of it condensates against the cool wall: part of the steam turns into water.
This is inefficient for the use of steam: a loss of capacity of the engine.

An improvement is the method of socalled 'compounding': expansion of the incoming steam is divided over two cylinders. Later it was even divided into three and sometimes four or more steps (multiple expansion).

In the first cylinder the steam expands only partly, then goes to the next cylinder for further expansion. This way there is less cooling per cylinder, so less condensation and therefore better efficiency.

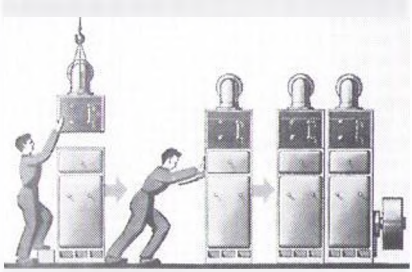


Spillingwerk steam engine

object: steam engine, vertical three cylinder
built by: Spillingwerk, Hamburg
year of construction: 1964

engineering,
stroke: 140 mm
bore: 270 mm (3 x)
nr. of revolutions: 330 turns/min, max. 750
operating pressure: 10 ato
energy: 285 hp, max. 480 hp
slide system: piston valve
regulator: regulated by oil pressure, mechanical adjustment

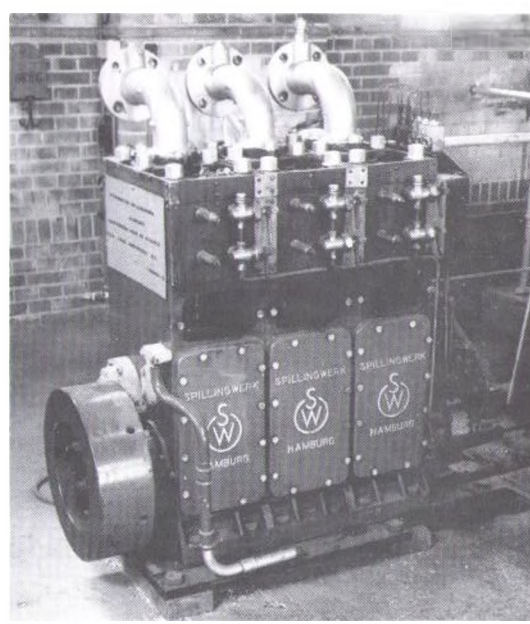
size LxWxH: 2.4 x 0.95 x 2.1 m
diameter flywheel: 760 mm
total weight: 4000 kg



This is a three cylinder steam engine, actually a steam motor. Since 1964 the engine stands at the Shell Refinery in Pernis. The engine operates a gas compressor in the solvents plant.

It is a steam engine with three cylinders. Or rather: three steam engines built next to each other to form one steam engine. For that is the principle of this engine. There is the possibility for extension per cylinder: another engine block is fitted next to it, a new crank shaft supplied and the engine can deliver more energy.

The description of steam motor is because the engine is completely enclosed and shows some semblance with a motor. The number of revolutions is high, there is pressure lubricating, the parts are exchangeable through serial production and the size is, with regards to the produced energy, small.



10

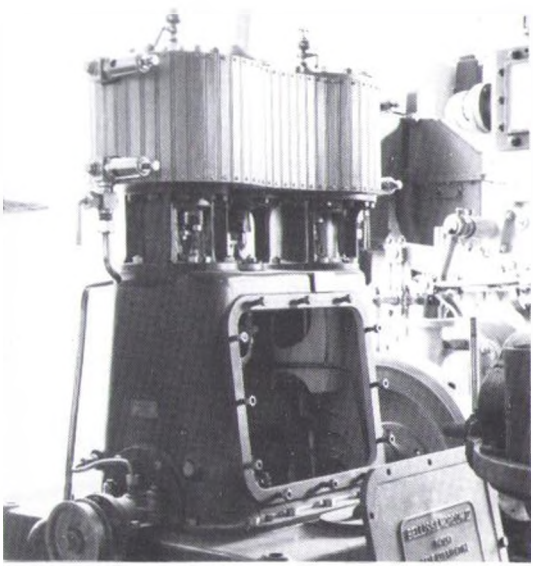
Fastrunning compound steam engine

In 1903 this engine is built for the Dutch Railways (then the H.Y.S.M.).
The engine stands some time in The Hague, in the engine building of the Electric Plant, and drives a generator. This way electricity is generated.
Later this engine is placed on a dredge to drive a centrifugal pump.

object: steam engine, two cylinder, vertical, compound
built by: Bellis & Morecom, Birmingham
year of construction: 1903

engineering,
stroke: 180 mm
bore: 205 and 355 mm
nr. of revolutions: 525 turns/min
operating pressure: 6 ato
energy: 100 hp
regulator: not present
slide system: H. P. and L. P. valve on one valve rod
details:
crank angle 180 degrees, self-lubricating, fitted spare parts

size LxWxH: 1.6 x 1.15 x 1.9 m
diameter flywheel: 830 mm
total weight: 2300 kg

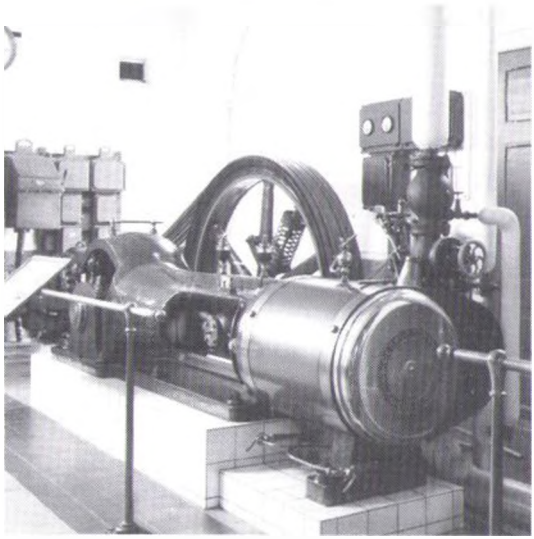


Steam engine from a dairy factory

object: steam engine, horizontal one cylinder
built by: Stork, Hengelo
year of construction: 1919

engineering,
stroke: 500 mm
bore: 300 mm
nr. of revolutions: 160 turns/min
operating pressure: 10 ato
energy: 125 hp
slidesystem: piston valve
regulator: Stork (in flywheel)

size LxWxH: 3.9 x 2.3 x 1.8 m
diameter flywheel: 2090 mm
total weight: 3500 kg



In 1919 the engine stands in the dairy factory 'Erica' of Coberco in Zelhem.
First the engine is used to operate a complete driving mechanism. Later the engine gets another function: to drive a generator.

heat power coupling

There are plants where a lot of heat is needed in the production process. For instance in a dairy factory, a paper mill, a potato flour works, or in a laundry.
A good choice in this case is to use a steamengine to drive the tools: the exhaust steam most of the time carries enough energy to supply in any case part of the need for heat.
An early form of heat power coupling.

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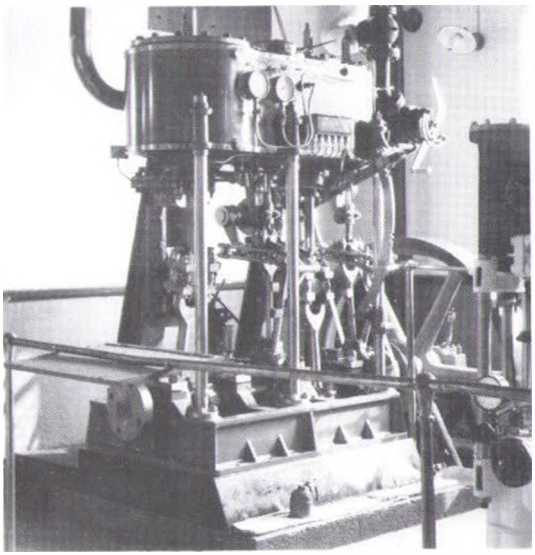
12

Ship's steam engine from a dredge



object: steam engine, vertical two cylinder compound
built by: Burgerhout, Rotterdam
year of construction: 1931

engineering,
stroke: 280 mm
bore: 225 and 450 mm
nr. of revolutions: 200 turns/min
energy: 120 hp
reverse movement: Stephenson
slide system: 2 x piston valve
regulator: Gardner Governor (ball)

size LxWxH: 2.6 x 1.9 x 3.0 m
diameter flywheel: 1500 mm
total weight: 2500 kg

Such a steam engine really could stand anywhere: a source of power, that can be used in different places.

Just look at the history of this engine: built in 1931, with the crank shaft and cylinder block in fact made for an engine on a navy tug.
In the end the dredging company Bons of Sliedrecht buys the superfluous parts and has them assembled into a complete engine, that eventually drives the bucket chain of the dredger 'De Hoop'.

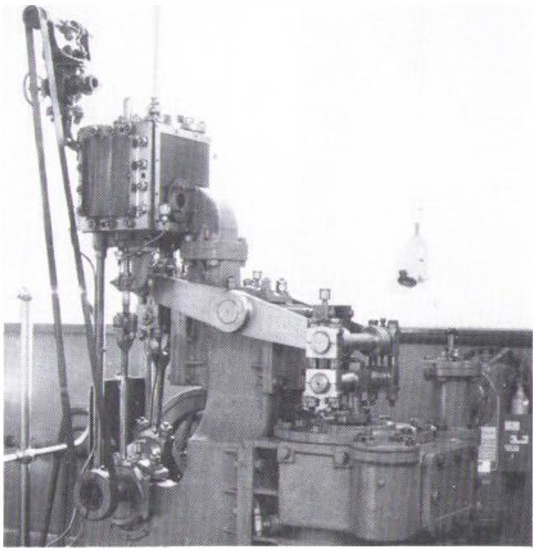
Auxiliary engine from a dredge

object: steam engine, vertical one cylinder with Edwards pump
built by: Burgerhout, Rotterdam
year of construction: 1931

engineering,
stroke: 200 mm
bore: 175 mm
nr. of revolutions: 100 turns/min
operating pressure: 10 ato
energy: 15 hp
slide system: shell valve
details: beam transmission

size LxWxH: 1.5 x 0.95 x 2.05 m
diameter flywheel: 880 mm
total weight: 1000 kg

This is an auxiliary engine for the engine mentioned before (object number 12 in the exhibition) and was also used on the dredger 'De Hoop'.
The engine sucks the condensate from the condensor.
When the used steam cools in the condensor (which is not installed here) to water, it will cause a vacuum. The pressure inside the condensor is lower than outside. Therefore the condensate will not flow of its own accord outside and will have to be pumped out. This is done by this engine (pump). The vacuum however must be maintained.
Through the vacuum the engine gets less back pressure during the removal of the used steam. This enhances the efficiency.



14

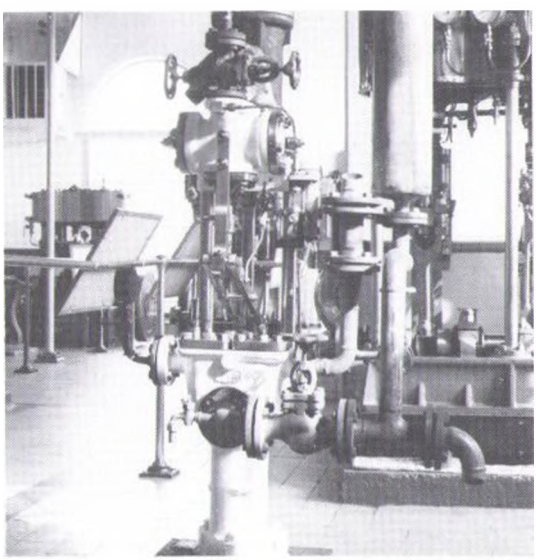
Pump

This socalled Wier's pump serves for years as a boiler feed pump at the Norit company in Zaandam, where active carbon is produced for water and air filters.
During the production of active carbon in special furnaces a lot of heat comes free, and this is used to heat the steam boilers. Part of the steam is then reused in the production to drive machines like this pump.
Experts will without a doubt remember this pump. On nearly every ship there was one to be found. The operation of especially the complex steam slide valve is so complicated, that there is nowhere near enough space on this page to explain its workings.
In old study books it even is the only engine of which a moveable model is added as an appendix.

object: Steam pump
built by: Weir
year of construction: 1960

engineering,
stroke: 300 mm
bore: 150 mm
nr. of revolutions: 180 turns/min
operating pressure: 10 ato
slide system: Weir

size LxWxH: 1.1 x 0.7 x 1.7 m



Part of the engine room from a dredger

object 15 steam engine, vertical two cylinder compound
built by: Engineplant De Klop, Sliedrecht
year of construction: 1928

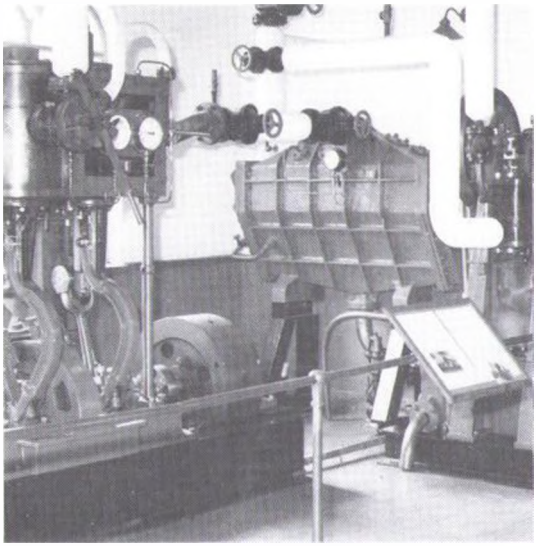
engineering,
stroke: 300 mm
bore: 240 and 440 mm
nr. of revolutions: 180 turns/min
energy: 150 hp
reverse movement: Klug
slide system: H. P. piston valve, L. P. shaft slide (Trick)
size LxWxH: 3.3 x 1.8 x 2.5 m
diameter flywheel: 735 mm

object 16: condensor, surface
built by: Engineplant De Klop, Sliedrecht
year of construction: 1928
size LxWxH: 1.8 x 0.65 x 2.1 m
total weight: 800 kg

object 17: steam engine, vertical one cylinder with Edwards wet airpump, circulation pump and feeder pump
built by: Engineplant De Klop, Sliedrecht
year of construction: 1928

engineering,
stroke: 240 mm
bore: 150 mm
nr. of revolutions: 120 turns/min
operating pressure: 10 ato
energy: 15 hp
slide system: piston valve
details: flywheels on top of the engine

size LxWxH: 1.5 x 1.0 x 2.2 m
diameter flywheel: 700 mm
total weight: 1500 kg



Together the engines form a complete part: a small piece from the engine room of the dredger 'De Maas' of the firm Prins v. Wijngaarde from Hattum. The dredger was active from 1928.

15

The large engine drives the bucket chain, forward or backward. Two directions: normally the bucket chain goes forward, but when the chain gets stuck, on a beam or a tree trunk, the chain is reversed and this removes the obstacle.

16

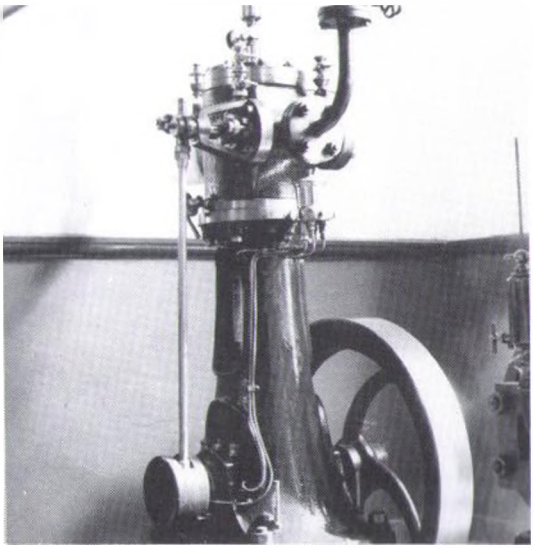
To the right, in the corner you find the condensor. In here the exhaust steam from the engines cools: steam liquifies to water and this water can be reused by reheating it in the boiler to steam.

17

The other engine is an auxiliary engine, to drive the pumps that are necessary for the condensor.

18

Auxiliary engine from the pumping station 'Vier Noorder Koggen'



object: steam engine, vertical one cylinder
built by: L. Smulders, Utrecht
year of construction: 1907

engineering,
stroke: 155 mm
bore: 110 mm
nr. of revolutions: 150 turns/min
energy: 6 hp
slide system: rolling valve

size LxWxH: 0.9 x 0.7 x 1.65 m
diameter flywheel: 760 mm
total weight: 800 kg

Originally in 1907 this engine was used as a vacuum pump to service the big centrifugal pump of the pumping station. When a centrifugal pump is started it needs to be filled with water. The water is not just poored in: no, with this engine, first the air is sucked out, which will cause the pump to fill with water.
Through this construction the engine can also be used as a compressor, or even under steam pressure to drive some tool.
We do here the latter, namely use the engine as a steam engine.

Engine from the dredge 'Koos'

object: steam engine, horizontal one cylinder
built by: De Hollandsche Ijssel, Oudewater
year of construction: 1890

engineering,
stroke: 335 mm
bore: 210 mm
nr. of revolutions: 90 turns/min
energy: 10 hp
slide system: shell valve

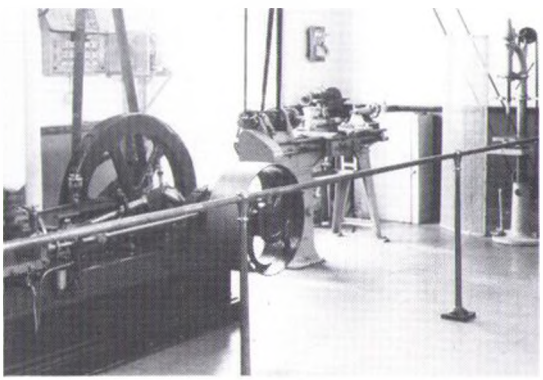
size LxWxH: 2.2 x 1.3 x 1.2 m
diameter flywheel: 1090 mm
total weight: 1100 kg

From 1890 the engine drives the bucket chain on the dredger 'Koos' of the firm de Koning from Medemblik.
Next to the engine you find a lathe and a drill press. The engine now operates this workshop.
Again this demonstrates: a steam engine can be used in a lot of places.

operation

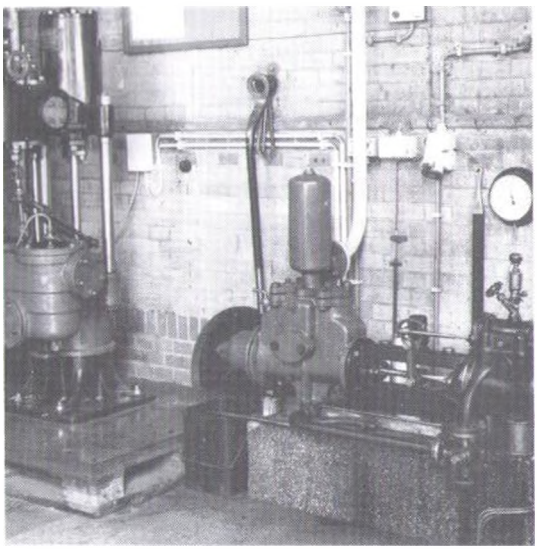
In factories steam engines operate the production engines, through a complex system of connecting axles and belts and ropes. A steam engine starts in this way a whole factory up.

How that happens can be very well seen here: left you see the steam engine and above on the ceiling you see a system of shafts and belts.
Behind the flywheel of the steam engine there is a pulley: around this loops a driving belt and this is connected above through a connecting shaft to the transmission shaft. On this shaft you see more pulleys with looped around them more driving belts. This way the steam engine operates various tools: to the extreme right the drill press and more to the centre the lathe.
By looping the belts crosswise the direction of rotation can be changed.
Through step pulleys the number of revolutions can be modified.. This way the lathe and drill press have three different speeds.



20

Feed water pump



object: steam pump,
horizontal one cylinder Simplex
built by: Schäfer und Budenberg
year of construction: 1925

engineering,
stroke: 150 mm
bore: 130 mm
nr. of revolutions: 180 turns/min
operating pressure: 13 ato
slide system: simplex

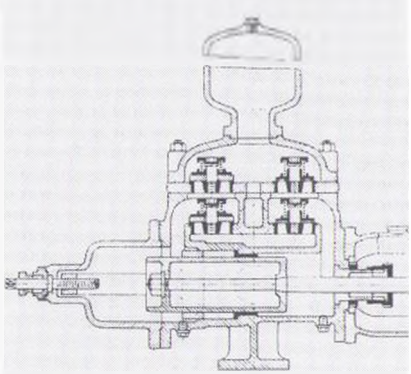
size LxWxH: 1.3 x 0.4 x 0.8 m
total weight: 200 kg

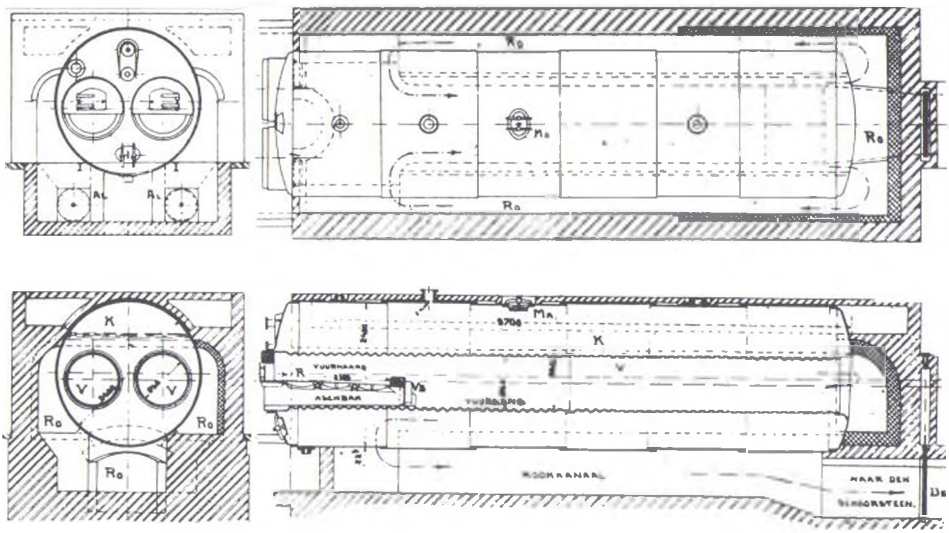
This pump is in service from 1925 and it pumps water into the boilers, from a reservoir. If this is not done regularly the boiler would eventually boil dry.

pumping

A water pump also works with a piston in a cylinder.
There is a suction and a delivery passage, each with a valve that can open and close. The suction passage is connected to a water reservoir, and the delivery passage is connected to the boiler.

In the cylinder arises a sub-atmospheric pressure when the piston moves to the right: the valve of the suction passage opens and the water flows inside. Then the piston moves to the left: the water closes the suction valve and opens the delivery valve. Now the water flows outside into the delivery passage.
Such a pump also exists as a double action pump.



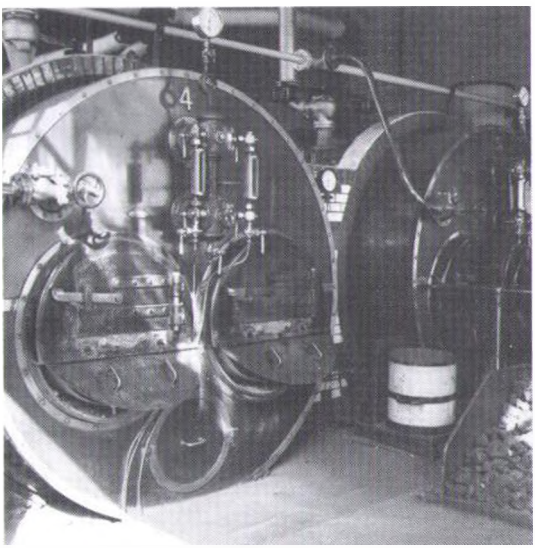


fire tube boilers

The Lancashire boiler is a 'fire tube boiler', lying horizontally in masonry. A large 'cask' with a diameter of two metres and a length of nine metres.
Along its length there are two fire tubes. At the front of the fire tube the fireman maintains the fire by throwing coal onto a grate. From here the fire tubes run through the boiler itself and there are also passages through the masonry.
The draught from the flue sucks up the flames and the flue gasses and these journey a long way: from the front to the back the flames travel through the fire tubes in the boiler, and the flue gasses are going around once more via the passages in the masonry on the outside of the boiler. After that they disappear up the chimney.
In this way the water in the boiler is heated from the inside and the outside. The steam leaves the boiler through the main steam valve into pipes leading to the steam uni-flow-engine.
Since 1985 the steam also goes to the other engines.

21

The steam boilers of the pumping station



object: boiler, nr. 4 and 5, Lancashire
built by: engineering works 'Breda" v/h Backer & Rueb
year of construction: 1925

engineering,
operating pressure: 13 ato
heated surface: 75 square metres
superheater: 40 square metres
energy: around 2500 kg of steam per hour

size: length 9.0 metres
diameter: 2.2 metres
total weight: 25000 kg per boiler

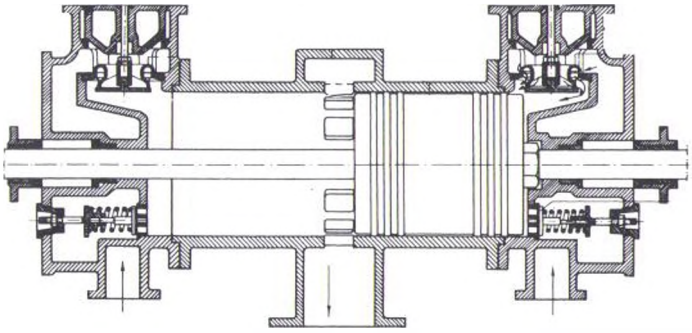
From 1925 till 1971 these boilers form the basis of the steam supply in this pumping station.
Through pipes the steam travels to the big steam engine for continuous current (object number 22 in the exhibition).
When on pumping days the engines of the pumping station have to operate, boiler number 4 is heated up.

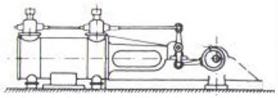
In the Lancashire area in England this type of boiler was first built after 1840. This is why they are called 'Lancashire' boilers.

continuous current

Here the term continuous current has nothing to do with electricity, but refers to the way the steam travels.
With the steam engine for continuous current the inlet of new steam is at the ends of the cylinder, while the outlet of used steam is in the centre. The inlet and outlet of steam are far apart here.
On the side of the outlet there has to be a vacuum for a good performance of the engine. To achieve this a condensor and an air pump are installed in the basement.
Through the separation of these routes there is hardly any condensation of the incoming steam against the cylinder wall.
As with the engineering of the 'compound' this reduces the consumption of steam and gives a better efficiency in the engine.

The operation of the centrifugal pump occurs via a shaft from the engine to the axle of the pump.





22

Main engine of the pumping station

object: steam engine, one cylinder horizontal uni-flow
built by: engineering works 'Breda' v/h Backer & Rueb
year of construction: 1924

engineering,
stroke: 800 mm
bore: 610 mm
nr. of revolutions: between 120 and 130 turns/min adjustable
operating pressure: 13 ato
energy: 550 hp
slide system: Lentz
regulator: Proell

size LxWxH: 9.6 x 4.0 x 2.0 m
diameter flywheel: 4050 mm
total weight: 32000 kg

Between 1925 and 1971 this engine performs the operation of the large centrifugal pump of the pumping station (object number 25 in the exhibition). It is a steam engine for uni-flow.
In 1971 the boilers are condemned and this engine cannot fullfill its function anymore. To be able to use the large pump of the pumping station a diesel engine is installed instead (the flywheel was removed from the shaft for this). The pit for the fly wheel was enlarged and a big pulley was installed on the shaft. The pulley parts can still be seen near the exit of the parking area.
The diesel engine was placed in the centre of the big hall and it operated the pump by means of a thick flat driving belt.

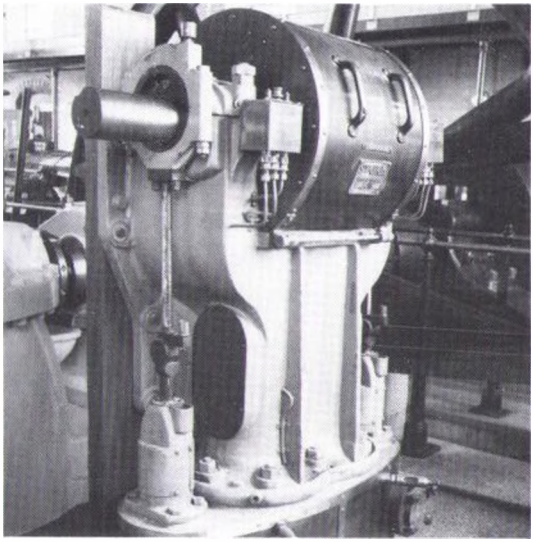
During the period of restoration boiler nr. 4 received new fire tubes and the engine was fitted with a new crank.
So they have started a second life in the museum: in 1985 the boiler is completed and approved and the steam engine once again is the basis of the operation of all machines in the building.

Auxiliary engine used in the sugar industry

object: steam engine, two cylinder
built by: Stork, Hengelo
year of construction: 1959

engineering,
stroke: 200 mm
bore: 185 mm
nr. of revolutions: 175 turns/min
operating pressure: 10 ato
slide system: piston valve
details: nr. 7581

size LxWxH: 1.3 x 0.7 x 1.7 m
total weight: 1500 kg



In 1959 it is planned to deliver this engine to Indonesia. However because of the political situation this does not occur. And so the engine is for a time a teaching attribute in the MTS-Zuid in Rotterdam. This is the reason why the engine has never yet operated.

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24

Centrifugal pump of the pumping station

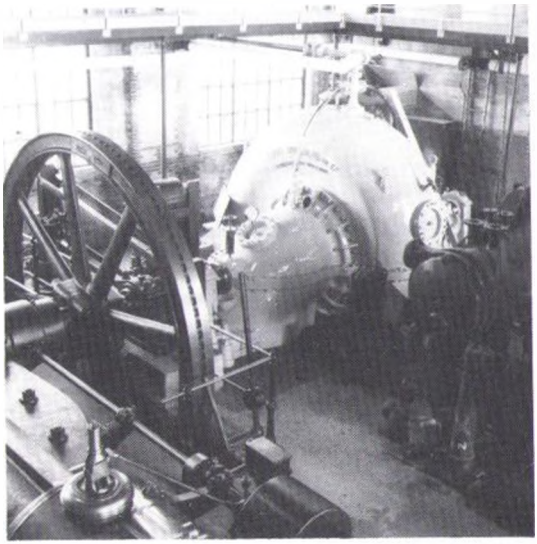
During the extension of the pumping station in 1907 this centrifugal pump was installed.
Till 1925 it is operated by a gas motor. After that the task is taken over by the steam uni-flow engine (object nr. 22 in the exhibition).

All about the operation of a centrifugal pump you can read under object nr. 5.

object: pump centrifugal
built by: L. Smulders, later Jaffa
year of construction: 1907

engineering,
nr. of revolutions: 120 up to a max. of 130 turns/min
energy: 450,000 litres per minute at a lift of 2 m

size LxWxH: 5.6 x 4.6 x 3.5 m
total weight: 40000 kg

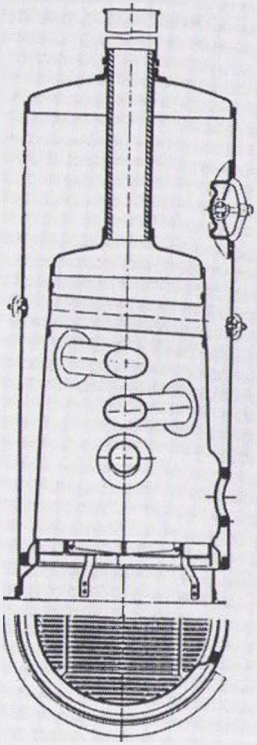


An exploded steam boiler

object: boiler, vertical boiler (three way pipe)
built by: D. P. Hasselman
year of construction: 1900

engineering,
operating pressure: 7 ato
details: explodes

size LxWxH: 1.4 x 1.1 x 2.9 m
total weight: 2000 kg

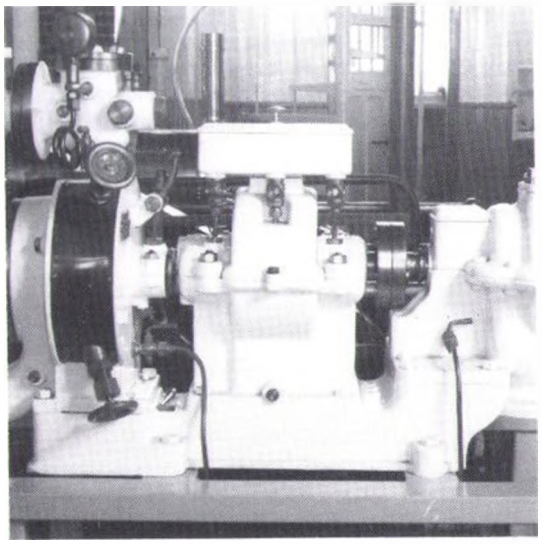


It happens in 1912.
Obliquely across from the current Olympic stadium on a building site in Amsterdam.
The boiler belonging to the pile-driving installation becomes overheated and explodes: it flies 300 metres through the air and burrows itself 3.5 metres into the ground upon landing.

Overheating occurs when there is too little water in the boiler.

26

Turbine



object: steam turbine, Laval 1 blade wheel, cogwheel reduction, small centrifugal pump
built by: Laval
year of construction: 1925

engineering,
nr. of revolutions: 30000 turns/min
operating pressure: 8 ato
energy: 5 hp
nozzles: one for usage with a condensor,
one for low and one for high back pressure

size LxWxH: 1.3 x 0.7 x 1.50 m
total weight: 200 kg

This is really an odd one out: it's not a piston steam engine but a steam turbine.
Around 1925 this engine operates through gearwheels a centrifugal pump.

engineering

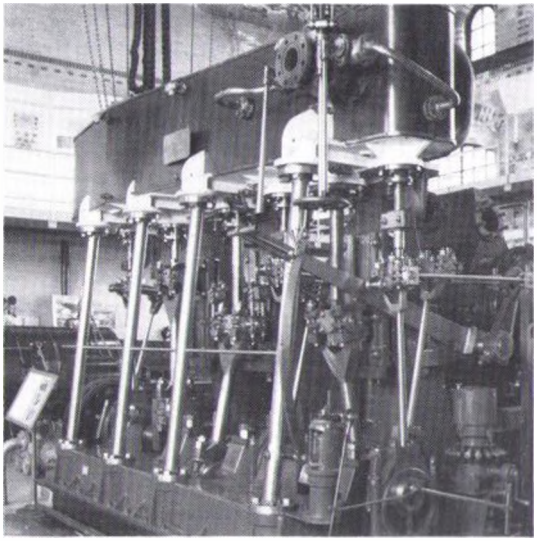
Not a backwards and forwards movement but a rotating movement: via socalled nozzles the steam is pointed onto the blades or scoops of a blade wheel, and this causes it to rotate. Usually with a very high speed.
The steam turbine is often through cogwheels connected to, for instance, a generator or a centrifugal pump.
Direct coupling also is possible: this is without cogwheels or some other driving gear.
Look at the blade wheel under the engine too.

Ship's engine from a hopperbarge

object: steam engine, three cylinder, triple expansion
built by: Carels & v.d. Kerchove, Gent
year of construction: 1935

engineering,
stroke: 425 mm
bore: 315, 495 and 855 mm
nr. of revolutions: 140 turns/min
operating pressure: 14 ato
energy: 450 hp
reverse movement: Stephenson
slide system: piston valves with canals

size LxWxH: 3.8 x 2.5 x 3.0 m
diameter flywheel: 800 mm
total weight: 18000 kg



The 'Vlaanderen VII' is a hopperbarge: a special vessel that is used during dredging. The bottom of the vessel opens up and the load is dumped all at once below the vessel.
Usually such a hopperbarge is towed, but in 1935 the 'Vlaanderen VII' propels itself by way of the operation of a steam engine.
The engine has three cylinders and, unlike what is usually the case, all three are fitted with a piston valve. Normally the average pressure and the low pressure cylinder have a flat slide because of the conduit capacity of the canals.
Through these three piston valves the engine has a remarkably long built.

28

Former demonstration model

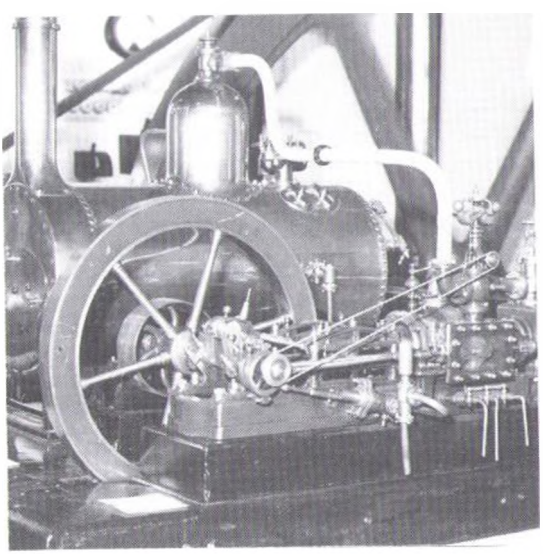
In 1864 this engine is built by the firm 'Suyver' in Amsterdam. It was probably a demonstration model for the company.

Later this engine is placed in the Evoluon in Eindhoven. It is now on loan from 'Philips'.
Through the plexiglas window on the slide valve chest you can see excellently how the slide system is made. On top of the main valve there are fitted two socalled expansion valves. The distance between the valves can be adjusted: when the distance is enlarged the steam inlet to the cylinder opens shorter. Less steam enters the cylinder. In this way the capacity of the engine can be adjusted to the need at that moment.
This is called the Meyer expansion system.

object: model steam engine, one cylinder horizontal with boiler
built by: the firm Suyver
year of construction: 1864

engineering,
stroke: 100 mm
bore: 80 mm
operating pressure: 2 ato
slide system: Meyer
regulator: spherical
details: injection condensor behind cylinder

size LxWxH: 1.1 x 1.0 x 1.0 m
diameter flywheel: 500 mm
total weight: 400 kg



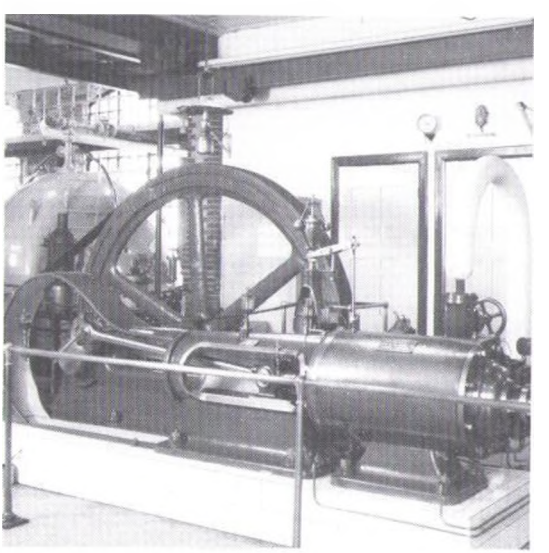
Steam engine with generator

object: steam engine, horizontal one cylinder
built by: v.d. Becke & Co., Sundwig
year of construction: around 1896

engineering,
stroke: 600 mm
bore: 365 mm
nr. of revolutions: 80 turns/min
energy: 50 hp
slide system: Guhrauer, expansion valve
regulator: Porter

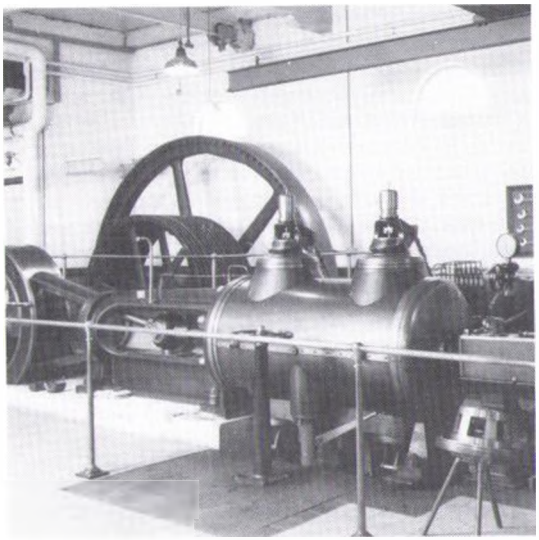
size LxWxH: 5.4 x 2.4 x 2.2 m
diameter flywheel: 2800 mm
total weight: 4800 kg

At the beginning of this century each plant that needs electricity has to provide it for itself. In 1895 this engine is situated in a small blast furnace operation, somewhere in the Ruhr area, an industrial area in Germany.
The engine operates a generator and this machine generates electricity. This supplies the electricity need of the wire rolling department.
The special slide movement of this engine shows a similarity with the movement of object number 28. The adjustments of the valves is done by a regulator, the device above the engine with the two turning spheres. As soon as the engine operates with too high a number of revolutions, the regulator adjusts the expansion valves. This reduces the capacity of the engine and the number of revolutions will not further increase.
When the number of revolutions decreases, more steam enters into the cylinder and the capacity increases. All without the assistance of the engineer.



30

Steam engine from a dextrin-plant



object: steam engine, horizontal one cylinder
built by: Stork, Hengelo
year of construction: 1902

engineering,
stroke: 900 mm
bore: 440 mm
nr. of revolutions: 120 turns/min
operating pressure: 10 ato
energy: 400 hp
slide system: Lentz
details: nr. 1276

size LxWxH: 8.6 x 4.6 x 2.2 m
diameter flywheel: 4000 mm
total weight: 18500 kg

This engine operates a whole plant: till around 1974 the installation operates in a potato flour factory of Scholten Honig v/h Wilkens & Co in Veendam.

All shaking, stirring, filtering and mixing machines work through the operation of this steam engine.

engineering

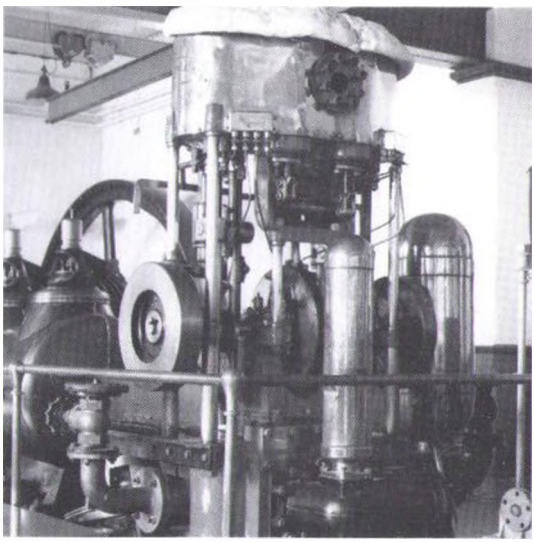
The engine does not have steam slides, but valves that regulate the inlet and outlet of steam. Two valves above the cylinder, of which the lift is adjustable (this is done by a regulator) for the incoming steam and two valves below the cylinder for the used steam.
The valves work via a side axle operated of the crank shaft through a right angle bevel gear system. This way the valves open and close at the right moments.

Vertical fire engine pump

object: steam fire engine pump, vertical two cylinder
built by: Merryweather, London
year of construction: 1940

engineering,
stroke: 200 mm
bore: 260 mm
nr. of revolutions: 200 turns/min
operating pressure: 10 ato
energy: 140 hp
slide system: piston valve
details: pump completely made of brass

size LxWxH: 1.9 x 1.1 x 2.3 m
diameter flywheel: 405 mm
total weight: 2500 kg



In 1940 the engine is installed in a floating crane (a pontoon) and is used to pump up slacking water. Such an engine is then in a permanent installation: the engine is stationary.

(In the old days the fire brigades also had such engines, only a lot smaller. The engine was installed on a wagon with the inclusion of a small vertical boiler. When a fire broke out horses were teamed up to the wagon and during the drive the boiler was fired up. After arrival at the scene of the fire the extinguishing could start immediately: with water delivered by such a pump. Extinguishing fire with fire...)

32

Steam roller

object: steam roller
built by: Ruthemeyer, Soest (Germany)
year of construction: 1927

engineering,
stroke: 200 mm
bore: 115/190 mm
nr. of revolutions: 150 turns/min
energy: 5.5 hp
reverse movement: Stephenson
slide system: shell valves
details: two cylinders on one crank axle (Single Crank Compound SCC)

boiler,
operating pressure: 10 ato
heated surface: 6 square metres

size LxWxH: 5.0 x 2.06 x 3.06 m
diameter flywheel: 1.22 m
total weight: 10000 kg

The museum also manages many collection pieces not permanently, or not (yet), included in the exhibition. An excellent example of this is the steam roller. This piece is on loan from Ooms of Avenhorn and it is definitely worth preserving. However the roller is not exhibited in the museum. Occasionally it is used for demonstrations on the museum grounds, or it is used to enhance a steam event. A few times a year the roller is collected by the owner to perform an official opening of for instance a road, a road crossing or a roundabout. In the early days the steam roller was used to roll broken stone roads. This type of rolling was called slam rolling. These rollers are fitted with wider back wheels than the ordinary detritus rollers, so they would leave fewer tracks or ruts.

Colophon

This is a publication of the

Nederlands Stoommachinemuseum
Oosterdijk 41671 HJ Medemblik
tel. 0227 - 544732

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Afdeling Maritieme Historie,
Marinestaf

U bent aan het eind van de gids gekomen of U leest de gids thuis nog eens na.
Na het bezoek aan ons museum heeft U wellicht het gevoel van:

- Stoom dat is toch zo fascinerend, daar wil ik meer van weten, of
- Zo'n museum moet toch alle steun kunnen krijgen die er is, of
- Ik wil voortaan regelmatig geïnformeerd worden over het wel en wee van het Stoommachinemuseum, of
- Ik wil aan kennissen of familie iets laten zien over het Stoommachinemuseum, of
- Zo zijn er nog wel meer zaken te bedenken.....

Wij willen U graag attent maken op het bestaan van de Vereniging Vrienden van het Nederlands Stoommachinemuseum.

De Vereniging Vrienden heeft ten doel de belangen van het Stoommachinemuseum te behartigen (ook financieel), maar ook willen wij juist de leden (bezoekers) regelmatig informeren omtrent het Museum in het bijzonder en over stoom in het algemeen.
Voor dit doel geven wij minimaal 3x per jaar onze eigen Nieuwsbrief uit waarin allerlei stoomwetenswaardigheden staan.
Tevens verzorgen wij eens per jaar een excursie naar een of meerdere stoomobjecten in Nederland of in het nabije buitenland.

Voor ƒ25,- per jaar (het mag ook meer zijn) bent U lid en heeft U en een introducé vrije toegang tot het museum.
Interesse in het lidmaatschap van onze vereniging? Vul dan de inschrijfkaart in en stuur hem op of lever hem in bij de kassa!!

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Explanatory list of technical terms

bearing
an engine part that supports an axle and other rotating engine parts
blade
steam blows against this part of a turbine to turn the blade wheel
bore
diameter of the cylinder
condensor
a device to cool steam to water (to condensate)
- injection condensor
a condensor in which the cooling water is sprayed into the steam area, the condensate mixes with the cooling water
connecting rod
rod between the crank and the crosshead
crank shaft
the main shaft of the engine, this shaft turns the oscillating movement into a rotating movement
crosshead
a guiding of the piston rod, also the hinge joint between the piston rod and the connecting rod
cylinder
tube in which the piston moves
energy
amount of power that can be delivered in a fixed time
flywheel
a heavy wheel of cast iron for uniform turning of the engine
number of revolutions
number of turns per minute
operating pressure
the (steam) pressure under which the installation is operating
paddlewheel
a water elevating device that paddles water by means of blades
piston
round disc that fits exactly inside the cylinder, mounted on the piston rod
piston rod
transfers the power of the piston through the crosshead to the connecting rod
planet wheel
gearwheel rotating around another gearwheel
pressure
(tension) the force per surface area unit e.g. kg/cm2
pressure head
the difference of waterlevel between the delivery side and the suction side of a pump
pumping plant (station)
building where pumps are installed to keep the waterlevel in the polder at the desired height
quadruple expansion
quadruplex expansion
regulator
device to restrict the speed of rotation between predefined limits, also with a variable engine loading
reverse movement
system used to operate the engine forwards or backwards
rudder quadrant
part of a circle that is mounted on the rudder
screwjack
water pressure device operated by a jack with wormdrive
slide system
steam distribution by way of a slide valve according to a predefined system
- jacket valve
steam slide valve with double openings for steam supply and exhaust, encased in a jacket
- piston valve
cylindrical slide valve
- rolling valve
cylindrical steam slide valve that rotates instead of sliding
- shaft slide
steam slide valve with an additional canal to regulate a bigger steam supply and exhaust
- shell valve
flat steam valve in the form of a tray or box
steam pipe
pipe for the steam supply and exhaust
steam port
opening in the valve face
steam slide valve
regulates the steam supply and exhaust
steam slide valve chest
the space in which the steam slide valve moves
steam slide valve rod
connecting rod of the steam slide valve
stroke
the distance the piston travels in the cylinder; twice the length of the crank (one travel = one stroke, one turn = two strokes)
triple expansion
triplex expansion
valve face
the plane of travel of the steam slide valve
valve system
distribution of steam through valves according to a certain system

abbreviations and units of measurement

ampere
unit of electrical current
ato (atmosphere)
unit of pressure
1 atmosphere = 1.0336 bar
H.P.
high pressure
L.P.
low pressure
M.P.
medium pressure
turns/min
number of revolutions per minute
ovo
super overheater
hp
horsepower
1 hp = 75 kgm/s (kilogram metre per sec)
= 0.7355 kw (kilo watt)
vo
heated surface
volt
unit of electrical tension

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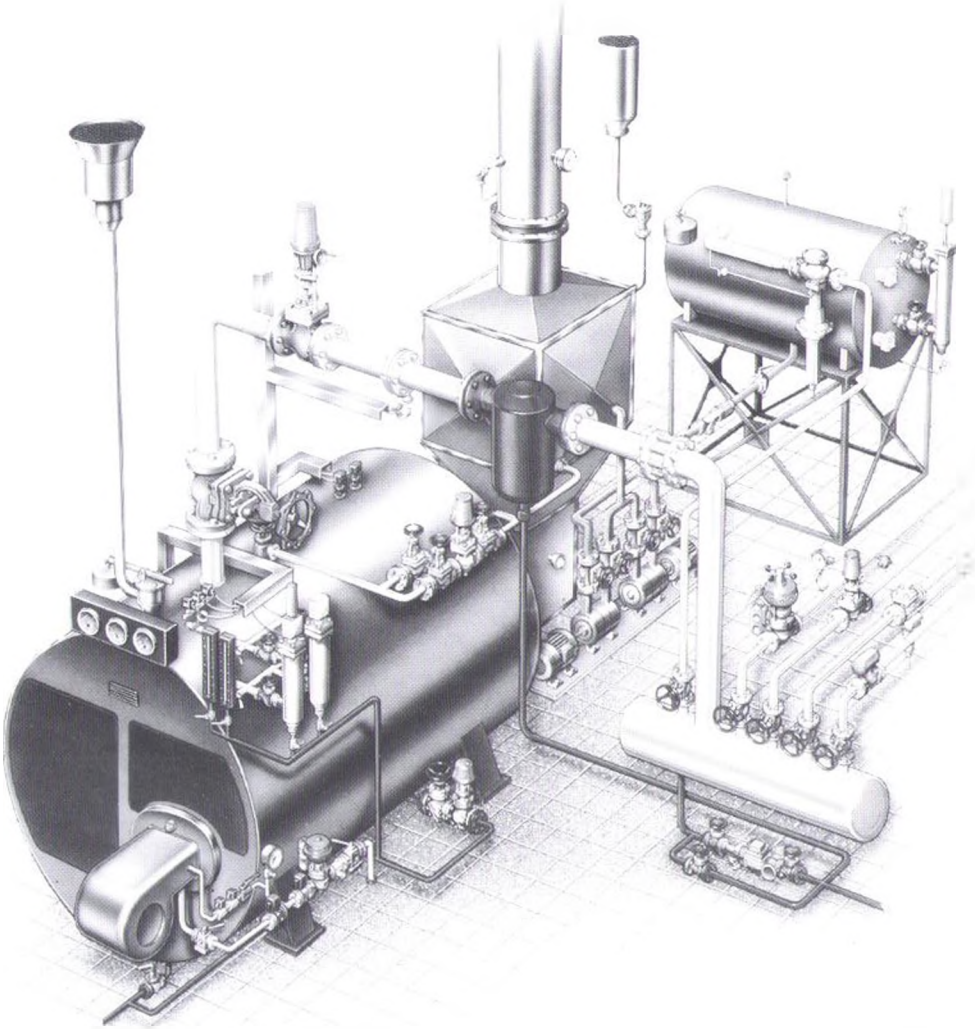

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